FINAL

RECORD OF DECISION

MILSTEAD ISLAND CREEK SITE
FORT EUSTIS, VIRGINIA

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

and

U.S. ARMY TRANSPORTATION CENTER
FORT EUSTIS, VIRGINIA

ENVIRONMENTAL, DPW
FORT EUSTIS/FORT STORY

Contract W912DR-05-D-004, D.D. #38

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1.1 SITE NAME AND LOCATION

The Site is known as Milstead Island Creek (Operable Unit 03, FTEUST-27), which is a tidally influenced stream that links the James River and the Warwick River and is within the bounds of the U.S. Army installation designated as Fort Eustis, Virginia (EPA CERCLIS ID # VA6210020321). As shown on Figure 1-1.

1.2 STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) determines that no remedial action is necessary for the Milstead Island Creek Site on Fort Eustis, Virginia. This decision is made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for the Site.

The Commonwealth of Virginia concurs with this decision.

1.3 NO ACTION DECISION

No remedial action is necessary for the Milstead Island Creek Site (Operable Unit 03, FTEUST-27), which consists of the sediment and surface water of Milstead Island Creek. Normal operational maintenance and/or use of the site may continue without restriction.

1.4 STATUTORY DETERMINATIONS

No remedial action is necessary to ensure protection of human health or the environment at the Site.

AUTHORIZING SIGNATURES

SEP 26 2008

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Colonel, US Army
Garrison Commander

OCT 10 2008

James J. Burke
Director, Hazardous Site Cleanup Division
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2.1 SITE NAME, LOCATION, AND DESCRIPTION

This Record of Decision (ROD) determines that no remedial action is necessary for sediment and surface water at Milstead Island Creek (FTEUST-27) at Fort Eustis, Virginia (EPA CERCLIS ID No. VA6210020321). USEPA has designated this Site as Operable Unit 03 (OU-03). The source of funds for CERCLA activities at Milstead Island Creek will be those authorized and appropriated annually by Congress under the Environmental Restoration, Army (ER,A) appropriation in the Department of Defense Appropriations Act.

Fort Eustis (the "Installation" or "Post") was placed on the National Priorities List (NPL) on December 16, 1994. The U.S. Army, as owner/operator of the Post, is the lead agency for purposes of CERCLA activity at Fort Eustis and jointly issues this ROD with USEPA Region III. The VDEQ is a support agency for the Post.

Fort Eustis is located in southeastern Virginia and borders the city of Newport News, Virginia. The total acreage of the installation has increased from 8,228 to 8,248 acres due to the recent purchase of a parcel of land known as the Redcross Property located along Dozier Road. The Fort Eustis military training facility hosts a number of specialized U.S. Army schools, plus garrisoned troops and supporting activities to manage the installation.

Milstead Island Creek is a tidal waterway that links the James and Warwick Rivers. The creek is located in the southern portion of the Fort Eustis Main Post Area (**Figure 2-1 and 2-2**). Milstead Island Creek was initially a natural waterway until a drainage canal was constructed as a link between the James and Warwick Rivers during the Civil War. The resulting water way consists of three distinct sections that comprise the extent of OU 3: the original extent of Milstead Island Creek, the dredged link in the center, and Butler's Gut (hence forth, unless specified otherwise, references to Milstead Island Creek include the complete extent of OU 3). The entire water way is tidal and flows in both directions, alternating between flowing into the Warwick and James Rivers in time with the tides. The drainage way is approximately 8,700 feet long and ranges from 40 to 100 feet across and 2 to 6 feet deep. The Site contains wetlands at both the James River and Warwick River intersections. The creek intersects the James River, along Harrison Road near the intersection of Taylor Road, and the Warwick River, adjacent to and south of Landfill 7.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

This section summarizes the Site history and Site investigations. No federal or state enforcement activities have been undertaken at Milstead Island Creek.

2.2.1 Site History

Milstead Island Creek is a tidal waterway that extends in an east-west alignment from the Warwick River at the eastern boundary of Fort Eustis to the James River, which forms the western border of the Installation.

During investigations of Milstead Island Creek conducted since 1989, sediment and water samples have been collected and the biota of the creek have been examined. Pesticides, metals, and fuel-related PAHs have been detected in the sediments and surface water of the creek.

2.2.2 Previous Investigations

The following field investigations have been conducted at the Milstead Island Creek Site:

- Remedial Investigation (Sirrine Environmental Consultants [SEC], 1989)
- Remedial Investigation (Phase I) (Montgomery Watson, 1990)
- Remedial Investigation (Phase II) (Montgomery Watson, 1993)
- Post-RI Sampling and Analysis (Malcolm Pirnie, Inc., 2002)

The 1990 and 1993 field investigations were presented in the Final Five Site Remedial Investigation (Montgomery Watson, 1997). The Post-RI Sampling and Analysis was presented in the Supplemental Site Evaluation (Malcolm Pirnie, 2006).

This section describes the results of these Site investigations. More comprehensive information on each investigation is presented in the respective reports, which are available in the Administrative Record and can be reviewed by the public at the Information Repositories identified in Section 2.3 of this ROD.

2.2.2.1 Milstead Island Creek Remedial Investigation Report - 1997

The 1997 RI Report for the Milstead Island Creek Site was based on three separate field investigations: the Landfill 7 RI completed in 1989; a 1990 RI focused on sediment in the creek; and a 1993 RI focused on surface water. The findings of these three individual field investigations that supported the 1997 RI Report are summarized below. The 1997 RI Report also included a human and ecological risk assessment which is discussed below.

Landfill 7 Remedial Investigation - 1989

A RI that included a portion of Milstead Island Creek was completed in 1989. The RI was focused on Landfill 7, which is adjacent to the eastern end of the Creek. During the course of the Landfill 7 RI, eight sediment and surface water samples were collected from the eastern portion of Milstead Island Creek and the Warwick River (which is adjacent to Milstead Island Creek).

The collected samples were analyzed for Volatile Organic Compounds (VOCs), Base-Neutral Acid Extractable Compounds (BNAs), pesticides/PCBs, Priority Pollutant (PP) metals, and Total Recoverable Petroleum Hydrocarbons (TRPH).

Surface water samples from Milstead Island Creek contained metals, VOCs, and BNAs; however, all concentrations were less than screening criteria (which are published values used to select chemicals present at concentrations that warrant further evaluation in the exposure assessment and risk characterization). Thus, based upon the investigation, no significant impacts were detected in regards to surface water of Milstead Island Creek, Butler's Gut, or the Warwick River.

Chloroform, BNAs, metals, and pesticides (specifically dichlorodiphenyldichloroethane [DDD], and dichlorodiphenyldichloroethylene [DDE]) were detected in the Milstead Island Creek sediment samples. BNAs detected in sediment samples included: chrysene, fluoranthene, benzo(b)fluoranthene, benzo(k)fluoranthene, and pyrene. Metals detected in sediment samples from the Creek included: aluminum, arsenic, barium, beryllium, copper, lead, selenium, thallium, and zinc.

The majority of chemicals were detected in samples collected from a location adjacent to Landfill 7, which was an operating solid waste landfill from 1951 to 1972. However, other samples taken between Landfill 7 and this location did not contain significant concentrations of the chemicals previously identified in the Creek. This indicates that Landfill 7 was not the primary source of the chemicals. Instead, as the Creek receives storm water from various areas (including maintenance-related locations) of Fort Eustis, it was concluded that these storm water discharge locations were the likely source of impact.

Based upon the investigation, it appeared that impacts were limited to Milstead Island Creek sediments only, as no impact was noted in sediment samples collected from the Warwick River (to which Milstead Island Creek discharges).

Remedial Investigation, Phase I – Sediment (Milstead Island Creek) - 1990

A RI was completed in 1990 focusing on Milstead Island Creek. The 1989 Landfill 7 RI found that the Creek sediment was impacted by a number of chemicals. However, as no significant surface water impacts were identified during the 1989 Landfill 7 RI, no surface water samples were collected during the 1990 Milstead Island Creek RI.

Fifteen sediment samples were collected from Milstead Island Creek. The samples were analyzed for pesticides/PCBs, VOCs, BNAs, total fuel hydrocarbons – heavy fraction (TPH-H), priority pollutant metals, extraction procedure (EP) toxicity metals, and cyanide. The following presents a summary of the analytical results for detected chemicals.

- One VOC, methylene chloride, was detected in a single sample. The chemical was identified as a laboratory artifact, and was not further considered.

- The BNA analyses identified fluoranthene in two samples and pyrene in one sample.

- The pesticide/PCB analyses detected the presence of DDD and DDE in most samples. In addition, dichlorodiphenyltrichloroethane (DDT) was detected in two samples, and Aroclor 1260, a PCB, was detected in one sample.

- TFH-H was detected in one sample.

- PP Metals analyses identified the following metals in all 15 samples (exceptions are noted): arsenic (13 samples) barium, beryllium (three samples), chromium, copper, mercury, nickel (14 samples), lead, and zinc.

Remedial Investigation, Phase II – Surface Water (Milstead Island Creek) – 1993

The 1993 RI was conducted to ascertain if Milstead Island Creek was impacted by surface runoff from Landfill 7. Four surface water samples were collected from the eastern portion of Milstead Island Creek, adjacent to Landfill 7. The surface water samples were analyzed for VOCs, BNAs, TFH-H, total fuel hydrocarbons – light fraction (TFH-L), pesticides/PCBs, and Target Analyte List (TAL) Metals (total and dissolved concentrations). In addition to the samples described above, two surface water samples were collected as part of a Landfill 7 monitoring program, these two samples were analyzed for the same chemicals, excepting the addition of cyanide and nitro-aromatic explosives. In addition, PP metals were analyzed rather than TAL metals. A summary of the surface water analyses is provided as follows.

- No VOCs, BNAs, or pesticide/PCBs were detected in the Milstead Island Creek surface water samples.

- Select TAL metals were detected in all surface water samples, but were not found at concentrations that exceeded screening criteria.

- TFH-H was detected in two of the four samples.

As groundwater flow in the vicinity of Landfill 7 is towards Milstead Island Creek, groundwater samples collected as part of a quarterly monitoring program for Landfill 7 were also considered in the 1993 RI. Based on the quarterly groundwater monitoring reports for Landfill 7, the RI concluded that the groundwater would not act as a significant source of impact to the Creek.

The RI concluded that the hydrocarbon impacts were most likely caused by surface runoff from maintenance or other facilities, not associated with Landfill 7.

2.2.2.2 Supplemental Site Evaluation (SSE)

The 1997 Milstead Island Creek RI (which includes the field investigations performed in 1989, 1990, and 1993) concluded the following:

- Little impact had been detected, but some localized fuel-related contamination was found in the sediment;
- Landfill 7 did not appear to be a significant source of impact for the Creek;
- Storm water runoff from adjacent sites appeared to be the primary source of impact for the Creek;
- Human health risk was considered acceptable; and,
- No significant risks to ecological receptors exist.

EPA Region III recommended in a letter dated December 8, 1998 to Dan Musel, Fort Eustis RPM that site-specific tests should be performed to refine the risk estimates for ecological receptors, as limited exceedances of environmental screening levels had been noted. The EPA indicated that direct toxicity could be an issue, and site-specific toxicity information would assist the determination that "no further action" was a valid decision. The EPA recommended further data collection and sample analysis focusing on the stretch of Milstead Island Creek that may have been affected by chemicals that exceeded the ecological screening criteria.

As such, the field investigation for the SSE, also referred to as the Post Remedial Investigation Sampling Event, was conducted in 2002. Additional data was gathered regarding Creek sediment, including: toxicity, chemical analysis, and benthic invertebrate studies.

The three parts of Milstead Island Creek Site (i.e., Milstead Island Creek, the dredged canal, and Butler's Gut) were selected for further investigation based on comparison of previous analytical data to the EPA's Biological Technical Assistance Group (BTAG) screening benchmarks. An unimpacted 'Reference Area' from a nearby creek (a small tributary of the Warwick River upstream of the site as shown on **Figure 2-1**) was sampled as well to provide a background comparison for the Milstead Island Creek data. The Reference Area data was used to compare the Milstead Island Creek data to a non-impacted site.

Sediment samples were analyzed for polynuclear aromatic hydrocarbons (PAHs, a subset of BNAs/SVOCs typically associated with petroleum), TAL metals, and pesticides/PCBs. Numerous PAHs and pesticides were detected in samples from Milstead Island Creek site during the SSE; however, only limited chemicals were detected at concentrations exceeding BTAG screening benchmarks. **Tables 2-1 to 2-4** present the analytical results from the sediment data for the parts of the Milstead Island Creek Site and the Reference Area. The following summarizes chemicals with respect to the screening levels:

- PAHs were detected in the sediment samples; however, all concentrations were less than BTAG screening benchmarks.
- DDE and DDT were detected at concentrations above BTAG screening benchmarks in sediment samples from the site.
- Chromium, mercury, copper, lead, zinc, and arsenic were detected in sediment samples from Milstead Island Creek and the Reference Area Site exceeding BTAG screening benchmarks.

In addition, sediment samples were collected to survey benthic organisms and test for toxic effects using a sample organism endemic to the Creek. Furthermore, sediment samples were analyzed for acid volatile sulfide/simultaneously extracted metals (AVS/SEM). The results of this analysis are used to evaluate the potential 'bioavailability' of particular metals. Eight sediment samples were also collected for sediment toxicity testing. This process included 10-day toxicity testing using an estuarine amphipod. This data was incorporated into a revised Ecological Risk Assessment (ERA) (which is detailed in Section 5.0, below).

The SSE found that though the Milstead Island Creek site had indications that it has been historically impacted by storm water runoff, the concentrations of target chemicals were generally no greater than the reference area. In addition, though benthic organisms are the most at risk from the impacted sediment according to calculations completed as part of the ecological risk assessment, the sampling found a greater number and variety of benthic specimens in Milstead Island Creek than in the reference area.

2.3 COMMUNITY PARTICIPATION

The Proposed Plan for this Site; the Landfill 7 RI report, dated February 1, 1989; the Final RI Report for Five Sites, dated February 1997; and the Supplemental Site Evaluation, dated March 2006 have been made available to the public. They can be found in the Administrative Record and in the information repositories maintained at the Grissom Library, 366 DeShazor Drive, Newport News, VA; the Christopher Newport University Library, 1 University Place, Newport News, VA; and the Groninger Library on Fort Eustis. The notice of availability of the Proposed Plan for this Site and these three documents was published in the *Newport News Daily Press* and in *The Wheel* (Fort Eustis's on-post newspaper) on October 1, 2006. A public comment period was held from October 1 to 31, 2006. The public meeting was held on October 26, 2006.

The Army mailed notices on September 29, 2006, to interested community members and organizations indicating the availability of the documents for review. The community mailing list was established during the development of Fort Eustis's Community Relations Plan (CRP) (1995) and was updated and expanded through the second edition of the CRP (2000). Individuals who had requested information on previous other CERCLA activities at Fort Eustis were added to the mailing list.

In addition, Fort Eustis has made efforts to involve the community by forming a Technical Review Committee, which is open to the public and meets semi-annually regarding the status of CERCLA activities at the installation including Milstead Island Creek. Notices regarding the Proposed Plan for this Site were also mailed to any member of the Technical Review Committee who had attended at least one committee meeting. No comments were received from the public at the meeting or during the comment period.

2.4 SCOPE AND ROLE OF NO ACTION DECISION

As a Federal Facility, Fort Eustis is on the NPL as a 'fence-line to fence-line' installation, with individual sites listed as separate OUs. In general, the OUs within the installation boundaries are not inter-related, but for purposes of work prioritization, the sites have been ranked by the Army, through a process known as Relative Risk Site Evaluation, as either high, medium, or low risk compared to one another. The Milstead Island Creek Site (OU-03), the subject of this ROD, is one of three sites on Fort Eustis ranked as a low relative-risk site by the Army.

An RI for Milstead Island Creek determined that chloroform and BNAs (chrysene, fluoranthene, benzo(b)fluoranthene, benzo(k)fluoranthene, and pyrene) were detected in soil/sediment samples collected in Milstead Island Creek (Montgomery Watson, 1997). DDD, DDE, and selected priority pollutant (PP) metals were also detected in these samples. Based on the location of these samples, near the confluence of Milstead Island Creek and Butlers Gut, it was concluded that the detections were likely related to surface water runoff.

In addition to Milstead Island Creek, which is OU-03, Fort Eustis has thirteen other individual OUs. A brief description of each OU and its current status is provided as follows:

- OU 01-Bailey Creek: This OU contains sediment impacted by historic release of PCBs. The RI for this OU was completed in 1997. The Army completed an interim removal action (IRA) in 2000, and the site currently is in the feasibility study (FS) stage.

- OU 02—Brown's Lake: This OU contains sediment impacted by historic releases of petroleum, pesticides and metals. An IRA was completed in 1999 through 2000. A ROD was executed in September 2007, and the Remedial Design was finalized in May 2008. The remedial action (RA) is anticipated for Summer 2008.

- OU 04—Eustis Lake: The RI for Eustis Lake found unacceptable levels of PCBs in fish tissue samples and sediment. As a result, a catch-and-release fishing restriction is currently imposed at the lake. This OU is currently in the FS stage.

- OU 05—DOL Storage Yard: The soil and sediment of this OU was impacted by a historic

pesticide spill (DDT). A ROD was issued in 2001, an RA involving excavation and disposal of impacted media was completed in 2003. This OU is currently in post-RA long-term monitoring.

- OU 06—Fire Training Area: Groundwater beneath the fire training area has been impacted by chlorinated solvents. The RI for this OU was completed in 1997. This OU is currently in the FS stage.

- OU 07—Oil/Sludge Holding Pond: Sewage sludge mixed with heating oil was buried at this site in the late 1970s. The RI for this OU was completed in 1997, and a ROD was issued in 2002. The ROD included the excavation and disposal of oil/sludge material and contaminated underlying soil. The RA was completed in 2004. This OU is currently in post-RA long-term monitoring.

- OU 08—Felker Airfield Tank Farm: This OU is an active tank farm servicing the adjacent Felker Airfield. Soil and groundwater associated with this site are impacted by petroleum hydrocarbons. An IRA was completed in 1994, during which 3,800 cubic yards of petroleum-contaminated soil were removed and treated at a bioremediation cell on Fort Eustis. The site is currently in the RI stage.

- OU 9—Landfill #7: This closed landfill is an non-permitted landfill, because it ceased operations before VDEQ issued regulations requiring permits. The landfill is reported to have received municipal solid waste from 1951 to 1972. The landfill was capped in 1994. A proposed plan is currently being prepared for the site.

- OU 10—Landfill #1: This closed landfill is a non-permitted landfill, because it ceased operations prior to VDEQs issuance of regulations requiring landfill permits. The landfill operated between 1937 and 1953, and received municipal solid waste and incinerator ash from the installation. The landfill was capped with soil. A proposed plan is currently being prepared for the site.

- OU 11—Former Skeet and Trap Range, Upland Area: This OU includes the upland areas associated with a former recreational trap and skeet range, with impacts to soils from lead and PAHs. Two IRAs have been conducted on this site to address the most heavily impacted soils. This OU is currently in the FS stage.

- OU 12—Former Skeet and Trap Range, Wetland Area: This OU includes the marsh areas associated with a former recreational trap and skeet range, with impacts to soils from lead and PAHs. This OU is currently in the FS stage.

- OU 13—1000” Rifle Range: This OU is a former small arms range in use during World War II. This OU is currently in the RI stage.

2.5 SITE CHARACTERISTICS

The following section provides an overview of the Site's physical characteristics and describes the nature and extent of Site contamination. In addition, based upon the information presented below, a Conceptual Site Model (CSM) was prepared. **Figure 2-3a** presents a conceptual site model that demonstrates the current and potential future uses of the Site and shows the complete human exposure pathways. **Figure 2-3b** presents a conceptual site model that demonstrates the ecological pathways and receptors.

2.5.1 Physical Site Characteristics

Milstead Island Creek is a tidal waterway that extends in an east-west direction from the Warwick River at the eastern boundary of Fort Eustis to the James River, which forms the western border of the Installation. Milstead Island Creek was initially a natural water way, until a drainage canal way was constructed to link the Warwick and James Rivers during the Civil War. The drainage way consists of three sections, which include Milstead Island Creek to the west, a connecting drainage canal, and Butler's Gut to the east, as shown on **Figure 2-1.** The estimated width of Milstead Island Creek varies from about 40 to 100 feet. The total length of the drainage way is approximately 8,700 feet, and the depth ranges between two and six feet.

Surface Topography and Hydrology

Milstead Island Creek lies in a topographically flat area of Fort Eustis. Only a slight variation in surface elevation exists to the south of the creek. A gently increasing slope borders most of the northern bank. The creek is located within the 50- and 100-year floodplains.

Because Milstead Island Creek connects the Warwick and James Rivers near the Chesapeake Bay, its flow direction is subject to tidal action. Surface runoff occurs from the topographically higher area on the creek's northern side. At least ten storm drain systems currently route storm water runoff to the Milstead Island drainageway. Wetlands exist adjacent to the creek channel, primarily in the vicinity of its confluence with the James and Warwick Rivers.

2.5.2 Nature and Extent of Contamination

The levels of impact at the Milstead Island Site are generally reflective of residual impacts from pesticide application and storm water runoff from parking lots and other industrial use sites. As such, significant sources of contamination are not an apparent issue. A summary of the nature and extent of contamination at the Site is provided as follows:

Sediment

Sediment in the Creek has historically been impacted by various metals, hydrocarbons, pesticides, and PCBs. Impacted sediment is apparently the result residual-level chemicals associated with storm water runoff. Generally, hydrocarbon impacts fall below the EPA BTAG screening benchmarks. Several metals (chromium, mercury, copper, lead, zinc, and arsenic) and two pesticides (DDT and DDE) have more recently been detected above the BTAG screening benchmarks. During the SSE the sediment from Milstead Island Creek was compared to that of a nearby creek as a reference area that was mutually selected by the Army and EPA. Milstead Island Creek and the reference area sediments did not significantly differ in regard to levels of hydrocarbons, pesticides/PCBs, or metals.

Surface Water

Surface water of Milstead Island Creek has not shown significant impacts (i.e., chemicals detected at concentrations that would cause excess human or ecological risk) throughout the 15 years of investigation, though TFH-H and metals have been detected in the surface water.

2.5.3 Fate and Transport of Chemicals of Potential Concern (COPCs)

COPCs, including various PAHs, metals, and pesticides have been found in the sediment of Milstead Island Creek, types of which exhibit carcinogenic or toxic properties (as further discussed in Section 2.7).

Some COPCs detected within the sediment of the Site are identified as environmentally persistent. While the COPCs themselves are not particularly mobile, due to bonding with fine-grained sediments, storm water flow can transport the fine-grained soil/sediment to which the COPCs have been bound.

Storm water run-off from Milstead Island Creek's urban-like watershed is likely to be the source of the contaminants because no point sources of contamination have been identified. The watershed contains a number of industrial sites, including locomotive repair yard, a historic pesticide mixing and storage area, and a number of vehicle and equipment storage yards and parking lots.

There are no subsurface transport pathways for COPCs at the Site due to the low permeability clay underlying the Site. Additionally, the affinity for fine-grained sediment of the COPCs tends to preclude downward migration. Potential transport pathways that are significant for this Site are:

- Transport of COPCs via suspension of sediment into the water column and fluid transport into Milstead Island Creek.

- Bioaccumulation into the food chain via invertebrates, fish, and potentially higher order predators.

2.6 CURRENT AND POTENTIAL FUTURE LAND USES

This section describes the current and future Site uses and identifies the potentially exposed populations at or near the Site under current and potential future conditions.

2.6.1 Current Situation

Approximately 4,510 military personnel and 4,944 Department of Defense (DoD) civilian and contractors are assigned to or working at Fort Eustis. As of 2006, there were 7,277 Permanent Party Active Duty Soldiers (including students) and 4,905 civilians on post, with 5,128 military personnel residing on post. While no residences are situated immediately adjacent to the Milstead Island Creek Site, some are within a short walk. Furthermore, the best description of current land use would be green-space or undeveloped. There are no current or planned restrictions on site use or access.

2.6.1.1 Land

At present, no residences surround (i.e., are immediately adjacent to) the creek, and the land is not used for commercial or industrial uses. The creek has a very limited potential for recreational uses (e.g., wading and fishing).

In addition, the Creek could be susceptible to trespasser traffic, which by the nature of the site would be similar to recreational uses.

2.6.1.2 Surface Water

Fort Eustis worker personnel or residential population exposures to the surface water through water consumption would not be expected, as the creek, due to its small size and brackish nature, would not be a reliable supply of water. The Newport News Waterworks supplies drinking water to Fort Eustis. However, incidental ingestion of surface water during recreational or maintenance activities is possible.

2.6.2 Future Land Use

Based on the master plan for Fort Eustis, the facility is expected to remain government property for the foreseeable future. The potential for future development of the creek is minimal due to

local topography and the need for drainage in the area. Therefore, it is likely that the land use of the creek will remain similar to current use.

2.7 SUMMARY OF SITE RISKS

The baseline risk assessment estimates what risks the Site poses if no action were taken. It identifies the contaminants and exposure pathways presented by site conditions and that may need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this Site.

2.7.1 Human Health Risk

An HHRA was conducted as part of the 1997 RI to determine the human health risks associated with the Site (Montgomery Watson, 1997). The CSM (**Figure 2-3a)** describes the basis of the HHRA for Milstead Island Creek.

2.7.1.1 Identification of Chemicals of Potential Concern

Tables 2-5 and 2-6, from the 1997 Risk Assessment and RI, and summarize the selection of the chemicals of concern. Presented in the tables are the frequency of detection and the range of detected concentrations for each chemical in sediment (**Table 2-5**) and surface water (**Table 2-6**), selected ARARs (e.g., Virginia Sediment Regional Background Standards and NOAA Status and Trends Regional Background), "to be considered" (TBC) criteria (e.g., EPA Region III RBCs) and the USEPA weight-of-evidence classification for known or suspected human carcinogens. The collection of ARARs and TBCs presented in the table are, in general, collectively referred to as risk screening criteria.

The detection frequency, concentration range, ARARs and TBC criteria are used to select COPCs for evaluation in the exposure assessment and risk characterization. COPCs are a subset of all chemicals detected at the Site with concentrations that are greater than the risk screening criteria (i.e., RBCs, etc.), which are used to characterize exposure and risk.

A direct comparison of risk screening criteria to the detected chemical concentrations indicates that Aroclor 1260, arsenic, beryllium and chromium concentrations in sediment exceed their respective screening criteria; therefore, these were chemicals were retained as COPCs for sediment. Surface water concentrations of manganese exceeded the screening criteria therefore, manganese was retained as a COPC for surface water. Fish tissue has several PAHs and phthalate analytes above their respective screening criteria, including acenaphthylene, dibenzothiophene, phenanthrene, and benzo (g,h,i) perylene; therefore, these were chemicals were retained as COPCs for fish tissue. No COPCs were retained for groundwater.

2.7.1.2 Exposure Assessment Summary

This section describes the complete exposure pathways by which the potential receptors may be exposed to the COPCs in the sediment and surface water via a specific exposure route. There are no COPCs for groundwater; thus, groundwater was not assessed for exposure pathways because no contaminants pose a risk, regardless of whether there is a completed pathway.

Conceptual Site Model

A conceptual site model was prepared for the Site to assess reasonable exposure scenarios and pathways of exposure. **Figure 2-3a** presents the conceptual site model that demonstrates the potential exposure pathways for the site. Potential pathways to receptors include dermal contact with surface water and sediments, incidental ingestion of surface water and sediments, and ingestion of fish.

Potential Receptors and Exposure Pathways Summary

As stated in Section 2.6.2, future land use is anticipated to remain the same as current land use. Therefore, for the current and future land use, the following potentially exposed populations to the impacted media at the Site are:

Fort Eustis Maintenance Personnel (adults)

- Ingestion of chemicals in surface water and surficial sediment in the creek
- Dermal contact with chemicals in surface water and surficial sediment in the creek

Recreational Populations (adults and children)

- Ingestion of chemicals in surface water and surficial sediment in the creek
- Dermal contact with chemicals in surface water and surficial sediment in the creek
- Ingestion of fish caught from the creek

2.7.1.3 Risk Characterization

Risk characterization is the final step in an HHRA. For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated using the following equation:

$$\text{Risk} = \text{Chronic daily intake (CDI)} \times \text{CSF}$$

where:

Risk = a unitless probability (i.e., 2 × 10-5) of an individual's developing cancer

CDI = chronic daily intake averaged over 70 years (milligrams per kilogram [mg/kg]-day)

CSF = carcinogenic slope factor, expressed as (mg/kg-day)-1

These risks are probabilities that usually are expressed in scientific notation (i.e., 1x10-6). An excess lifetime cancer risk of 1x10-6 indicates that an individual experiencing the RME estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as 1 in 3. EPA's generally acceptable risk range for site-related exposures is 10-4 to 10-6.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified period (i.e., lifetime) with an RfD derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effects. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ<1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The hazard index (HI) is generated by adding the HQs for all COCs that affect the same target organ (e.g., the liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI>1 indicates that site-related exposures may present a risk to human health. The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

CDI and RfD are expressed in the same units and represent the same exposure period (e.g., chronic, subchronic, short-term).

The HHRA assumed that the future land use would remain the same as current (i.e., a publically accessible creek), and identified two classes of potential future exposed populations for the creek: Fort Eustis maintenance personnel (adults exposed to sediment and surface water) and recreational users (adults and children exposed to sediment, surface water, and fish). The risk assessment determined that the sediment/surface water scenarios were similar for both the adult

recreational user and Fort Eustis maintenance work. Therefore, the sediment/surface water exposure scenarios for both the adult receptors were combined into a single receptor termed "adult receptor".

The HHRA determined that the total site risk (2.0×10^{-5} for adults and 1.0×10^{-5} for children) and hazard index (0.04 for adults and 0.03 for children), including combined exposures to surface water and sediment, as well as consumption of fish tissue, to be within the EPA risk-based remediation benchmarks of $1x10^{-6}$ to $1x10^{-4}$ for site risk and 1.0 for site hazard index. As such, no remediation was required or suggested due to human health risks.

2.7.2 Ecological Risk

Two ERAs were performed for this Site. The initial ERA was included in the 1997 Montgomery Watson RI; however this ERA was superseded by an ERA that was conducted as part of the Final Supplemental Site Evaluation using new analytical, sediment toxicity tests, and benthic macro invertebrate data (Malcolm Pirnie, 2006). As such, the ERA from the Supplemental Site Evaluation is summarized below and the Food Chain Model for the ERA is presented as **Figure 2-3b**.

2.7.2.1 Identification of Chemicals of Potential Concern

This section presents the chemicals detected in the Site surface water, sediment and fish tissue samples that were identified as COPCs, which are chemicals present in quantities exceeding screening values and thus pose the greatest potential significance to aquatic and wildlife receptors.

All analytical data were compared to USEPA Region III BTAG Fauna/Flora Screening Levels (1995) or other applicable ecologic screening values, if available. Other sources of applicable screening values that were considered included: the "*Screening Quick Reference Tables (SQuiRT)*" (National Oceanic and Atmospheric Administration, 1999,) and "*The Incidence and Severity of Sediment Contamination in Surface Waters of the United States*" (US Environmental Protection Agency, 1997). Chemicals were retained as COPCs if the media concentration exceeded the selected screening level. Chemicals retained as COPCs included the following:

Pesticides/PCBs	**SVOCs/PAHs**	**Metals**
Aroclor 12	Acenaphthylene	Arsenic
Total PCBs	Phenanthrene	Beryllium
Heptachlor	Dibenzothiophene	Chromium
Oxychlordane	Benzo(g,h,i)perylene	Lead
Heptachlor epoxide		Manganese
Gamma-chlordane		
2,4'-DDE/Endosulfan I		

Cis-chlordane
Trans-nonachlor
Dieldrin
4,4'-DDE
4,4'-DDD
4,4'-DDT

The exposure media of ecological concern at the Site are sediments in the creek bed and surface water. The maximum exposure concentration is assumed for all exposure assessment calculations as required by USEPA Region III guidelines. Maximum concentrations of COPCs in sediments from the creek and in surface water are used to estimate direct exposure of ecological receptors to COPCs in sediments as well as for modeling uptake into benthic invertebrates. Maximum concentrations of COPCs in fish tissue are also used to determine the COPC intake for predators. Finally, respective maximum concentrations for COPCs are used to compare against Region III BTAG concentrations to estimate potential impact to benthic communities themselves. Benthic invertebrates are either immobile or have limited mobility; the maximum value is believed to represent the exposure received by the most-exposed individual and, therefore, is a conservative estimate of the exposure experienced by the population.

2.7.2.2 Exposure Assessment

The following summarizes the ecological setting, target receptors, and potential exposure pathways.

Ecological Setting

Milstead Island Creek can be divided into three sections: the James River section to the west, the manmade channel in the middle, and the Warwick River section to the east. Each section displays differences in vegetation, tidal range and stream size.

The James River section to the west consists of tidal creek surrounded by low salt marsh. The marsh continues east along the creek as far as a railroad bridge located to the east of Mulberry Island Road. On the south side of this section is a stand of pines and a large dredge spoil area. At low tide, there are extensive areas of flats exposed. The dredge spoil rises approximately 25 feet above the marsh. On top of the spoil area is a large pool that is used by waterfowl and shorebirds. At its upper end, the marsh area is vegetated by a mix of fresh and saltwater marsh plants. At low tide, there are extensive areas of flats exposed.

The center section of the waterway consists of a long ditch connecting the two tidal creeks. The ditch runs from the railroad bridge east of Mulberry Island Road, west to a small bridge located south of the aircraft school training and maintenance area. High berms (approximately two

meters) run along both sides of the ditch with occasional breaks where small streams (storm water discharge) run into the channel. The channel almost completely drains out at low tide. Several vernal pools are on the south side of the ditch, behind the berm.

The Warwick River section at the eastern end of the creek (Butler's Gut) runs east into the Warwick River and its associated marshes. A landfill lies to the north of the creek, and oak/pine woods occur on its south side.

Species Summary

The Site is frequented by deer, small mammals, and a number of birds that feed on the insects and potentially the fish or crustaceans known to live in the creek. Fish-catching birds observed include great blue herons, great egrets, snowy egrets and osprey. These birds were observed in the shallows of the creek's mouth on the James River. Other birds observed include: Canada geese, mallards, wood ducks, clapper rail, marsh wren, red-winged blackbirds, and killdeer. Turtles observed in Milstead Island Creek include the diamondback terrapin, a federal- and state-listed endangered species. Amphibians are also expected to use the creek.

Plant species observed in and near Milstead Island Creek include: oak, pine, grasses, small shrubs, cattail, common reed, bulrush, marsh elder, saltwater cord grass, meadow grass and rush.

Exposure Pathways

Several ecologically relevant migration pathways for chemicals exist at Milstead Island Creek. Wildlife may ingest or have incidental contact with chemicals in surface water and sediment while foraging, nesting, or engaging in other activities on the Site.

Chemicals can also adversely affect plants and animals in surrounding habitats via the food chain. The ERA addressed incidental contact and ingestion as well as uptake of those chemicals in the food chain associated in the creek. This ERA did not evaluate water ingestion because the 1997 ERA (Montgomery Watson, 1997) found no significant risks to ecological receptors, and therefore, no surface water samples were collected for this ERA..

Some chemicals detected in creek sediment are persistent and may be transformed to more bioavailable forms, and thus, mobilized in the food chain. Mobilization of chemicals in the food chain under the conditions found at the Milstead Island Creek Site could occur through the following pathways:

- Contact and absorption, incidental ingestion, and feeding on contaminated food by invertebrates; and,
- Bioaccumulation from vegetation or animal prey at the base of the food chain by wildlife.

Based on these pathways, the following general classes of ecological receptors could be exposed to COPCs at the Site.

- Terrestrial invertebrates likely to occur in the bed of the creek;
- Benthic invertebrates occurring within the sediments of the creek;
- Birds that forage or nest near the creek;
- Piscivorous birds that feed on fish species in the creek;
- Small mammals that reside and/or feed in the vicinity of the creek; and,
- Other higher trophic-level wildlife species (e.g., carnivores) that feed within the vicinity of the Site.

Ecological Effects Characterization

Toxic endpoints for risk characterization were chosen in accordance with EPA guidelines and toxic effect data. Toxic endpoints may include: lethality, reproductive impairment, behavioral modifications, or various sub-lethal toxic effects. Endpoints may also include secondary effects such as loss of habitat.

Ecological Risk Characterization

Hazard Quotients (HQs) were calculated for each COPC and each assessment endpoint species. The HQ is the ratio of a single COPC's exposure level to a value that represents the COPC's estimated toxicity to the species. An HQ greater than 1 indicates that the COPC may pose a risk to the species investigated. An HQ less than 1 indicates that the COPC is unlikely to pose a risk to the species investigated.

Tables 2-7 and 2-8 present the COPCs that had HQs greater than 1.0 for the benchmark species. Benchmark species for the Site include: gray fox, muskrats, raccoons, great blue herons, and red-tailed hawks. HQs greater than 1.0 were found for 4,4-DDE and 4,4-DDT for raccoons; aluminum and arsenic for grey foxes; 4,4-DDT and aluminum for muskrats; and 4,4-DDE, 4,4-DDT, aluminum, and chromium for great blue herons and red-tailed hawks.

HQs for benthic invertebrates were not developed as a part of the Final Supplemental Site Evaluation. These calculations were not completed because there were twice as many benthic invertebrates found in Milstead Island Creek as were found in the Reference Area. This indicates that although the environment benthic invertebrates inhabit is stressed from physical conditions typical of a tidal creek (i.e. sub-tidal, organic/muck bottom, high salinity, low dissolved oxygen), a stable benthic population exists on the Site.

Summary of Ecological Risk

HQs were calculated for each COPC and each assessment endpoint species. The following summarizes chemicals that present HQs greater than 1.0, thus, indicating a potential for risk to the receptor species.

- Five of the eight COPCs had HQs above one including 4,4-DDE (raccoons, HQ of 2.6; great blue herons, HQ of 521; and red-tailed hawks, HQ of 498), 4,4-DDT (raccoons, HQ of 21.8; muskrats, HQ of 2.7; great blue herons, HQ of 4,350; and red-tailed hawks, HQ of 4,160), aluminum (gray fox, HQ of 23,600; muskrat, HQ of 8.7; great blue heron, HQ of 8.5; and red-tailed hawk, HQ of 8.2), arsenic (gray fox, HQ of 23.2), and chromium (great blue heron, HQ of 1,680 and red-tailed hawk, HQ of 1,610).

- Comparison in the Final Supplemental Site Evaluation of the metals retained as COPCs for the Site (aluminum, arsenic, chromium, copper, silver, and zinc) to metals measured in the Reference Area show that the concentrations were generally lower than, or equal to, those observed in the Reference Area. As such, metals were eliminated as COPCs.

- An AVS/SEM sediment analysis was conducted at both the Milstead Island Creek area and the Reference Area to determine if the COPCs identified in the ERA present a risk of becoming bioavailable for uptake in wetland plants, benthic invertebrates, and the ecological receptors identified in the ERA. Based on these analyses, there does not appear to be a significant amount of metal enrichment in the sediment to signify a potential for large concentrations of metal to become bioavailable to the Milstead Island Creek ecological receptors.

The ERA, a part of the Final Supplemental Site Evaluation completed in February 2006, determined possible effects of COPCs on ecological receptors at the Site. Many conservative assumptions were retained as a part of the ERA. Furthermore, the ERA represents an empirical estimate of potential impact to ecological receptors, rather than an evaluation of actual impacts to ecological receptors.

Results from the 10-day sediment toxicity testing indicated that, when compared to the Site's Reference Area, COPCs do not significantly affect the benthic invertebrates inhabiting the Site. Although the risk assessment shows there is a potential risk posed by some COPCs to the ecological receptors evaluated, the process of risk assessment is mathematically based, and does not represent entirely the effect these chemicals actually are posing to the species. However, the 10-day sediment toxicity testing, which illustrates empirically the risk of toxicity to the benthic community, provides a more likely representation of the actual threat to the species. This threat, in turn, is negligible in comparison to the data obtained from the Site's Reference Area.

Thus, based upon the results of this ERA and, specifically, the sediment toxicity testing, it is determined that the Site does not pose a significant risk to ecological receptors. Therefore, no further action is required to ensure that unlimited use of and unrestricted exposure to the Milstead Island Creek Site is protective of human health and the environment.

No response action is necessary to protect the public health or welfare or environment from actual or threatened releases of hazardous substances into the environment.

2.8 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for Milstead Island Creek (FTEUST-27, OU-03) was released for public comment in October 2006. The Proposed Plan identified No Further Action as the Preferred Alternative for remediation of the Site because it was determined that no significant risk to human health or ecological receptors exists. The Army received no comments during the public comment period. Therefore, it was determined that no significant changes to the remedy, as identified in the Proposed Plan, were necessary or appropriate.

This section details public comments on the Propose Plan for the Milstead Island Creek Site, subsequent responses by the Army and USEPA, as well as resolutions regarding both the remedial alternatives and general concerns, if any, about the Site.

No comments on the Proposed Plan for the Site were received.

ARARs	**Applicable or Relevant and Appropriate Requirements**
AVS	**Acid Volatile Sulfide**
BNAs	**Base-Neutral Acid Extractable Compounds**
BTAG	**Biological Technical Assistance Group**
CERCLA	**Comprehensive Environmental Response, Compensation and Liability Act**
CFR	**Code of Federal Regulations**
COPCs	**Constituents of Potential Concern**
CRP	**Community Relations Plan**
CSM	**Conceptual Site Model**
DDD	**Dichlorodiphenyldichloroethane**
DDE	**Dichlorodiphenyldichloroethylene**
DDT	**Dichlorodiphenyltrichloroethane**
DoD	**Department of Defense**
EE/CA	**Engineering Evaluation/Cost Analysis**
EP	**Extraction Procedure**
ERA	**Environmental Risk Assessment**
ER,A	**Environmental Restoration, Army**
FS	**Feasibility Study**
HMA	**Helicopter Maintenance Area**
HQs	**Hazard Quotients**
ug/kg (µg/kg)	**micrograms per kilogram**
mg/kg	**milligrams per kilogram**
mg/l	**milligrams per liter**
IRA	**Interim Removal Action**
NCP	**National Oil and Hazardous Substances Pollution Contingency Plan**
NPL	**National Priority List**
NOAEL	**No Observed Adverse Effects Level**
O&M	**Operation and Maintenance**
OSHA	**Occupational Safety and Health Administration**
OUs	**Operable Units**
OU-2	**Operable Unit 2**
PAHs	**Polynuclear Aromatic Hydrocarbons**
PCBs	**Polychlorinated Biphenyls**
PID	**Photoionization Detector**
PNW	**Present Net Worth**
RCRA	**Resource Conservation and Recovery Act**
RI	**Remedial Investigation**
ROD	**Record of Decision**
RBCs	**USEPA Region III Risk-Based Concentrations**
SARA	**Superfund Amendments and Reauthorization Act**
SVOCs	**Semi-volatile Organic Contaminants**
TAL	**Target Analyte List**
TBC	**To Be Considered**
TCE	**Trichloroethylene**
TCL	**Target Compound List**
TFH	**Total Fuel Hydrocarbons**
TFH-H	**Total Fuel Hydrocarbons-Heavy Fraction**

TFH-L	**Total Fuel Hydrocarbons-Light Fraction**
UCL	**Upper Confidence Limits**
USAEHA	**United States Army Environmental Health Agency**
USEPA	**United Stated Environmental Protection Agency**
VDEQ	**Virginia Department of Environmental Quality**

***Final Engineering Report Fort Eustis Remedial Investigation*, Sirrine Environmental Consultants (SEC), 1989**

***Final Five Site Remedial Investigation*, Montgomery Watson, 1997**

***Supplemental Site Evaluation,* Malcolm Pirnie, Inc., 2006**

Figures

Record of Decision
Milstead Island Creek
Fort Eustis, Virginia

Figures

Record of Decision
Milstead Island Creek
Fort Eustis, Virginia

MALCOLM PIRNIE

FORT EUSTIS, VIRGINIA
MILSTEAD ISLAND CREEK RECORD OF DECISION

SITE LOCATION

FIGURE 1-1

REFERENCE AREA

EUSTIS LAKE

GOOSE ISLAND

JAMES RIVER

AREA NO. 1

AREA NO. 2

AREA NO. 3

MILSTEAD ISLAND CREEK

DREDGE SPOILS AREA

MILSTEAD ISLAND CREEK CONNECTING DRAINAGE CANAL

BUTLER'S GUT

WARWICK RIVER

LANDFILL NO. 7

LANDFILL NO. 7

1000 0 1000

MALCOLM PIRNIE

FORT EUSTIS, VIRGINIA

MILSTEAD ISLAND CREEK RECORD OF DECISION
MILSTEAD ISLAND CREEK SAMPLING LOCATIONS

MALCOLM PIRNIE, INC.

FIGURE 2-1

EUSTIS LAKE

KELLS DRIVE

PET CEMETERY

SCHULTZ PLACE

24TH ST

TAYLOR AVE

WILSON AVENUE

BUNDY ST

WASHINGTON BLVD

GODMAN ROAD

WILSON AVE

LANDFILL NO. 7

LANDFILL NO. 7

WARWICK RIVER

AREA NO. 1

1 2 3 4

AREA NO. 2

1 2 3 4

AREA NO. 3

1 2 3 4

MILSTEAD ISLAND CREEK

DREDGE SPOILS AREA

BUTLER'S GUT

MILSTEAD ISLAND CREEK CONNECTING DRAINAGE CANAL

JAMES RIVER

OLD NURSERY

MULBERRY ISLAND ROAD

600 0 600

FORT EUSTIS, VIRGINIA

MILSTEAD ISLAND CREEK RECORD OF DECISION
MILSTEAD ISLAND CREEK SAMPLING LOCATIONS

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.

FIGURE 2-2

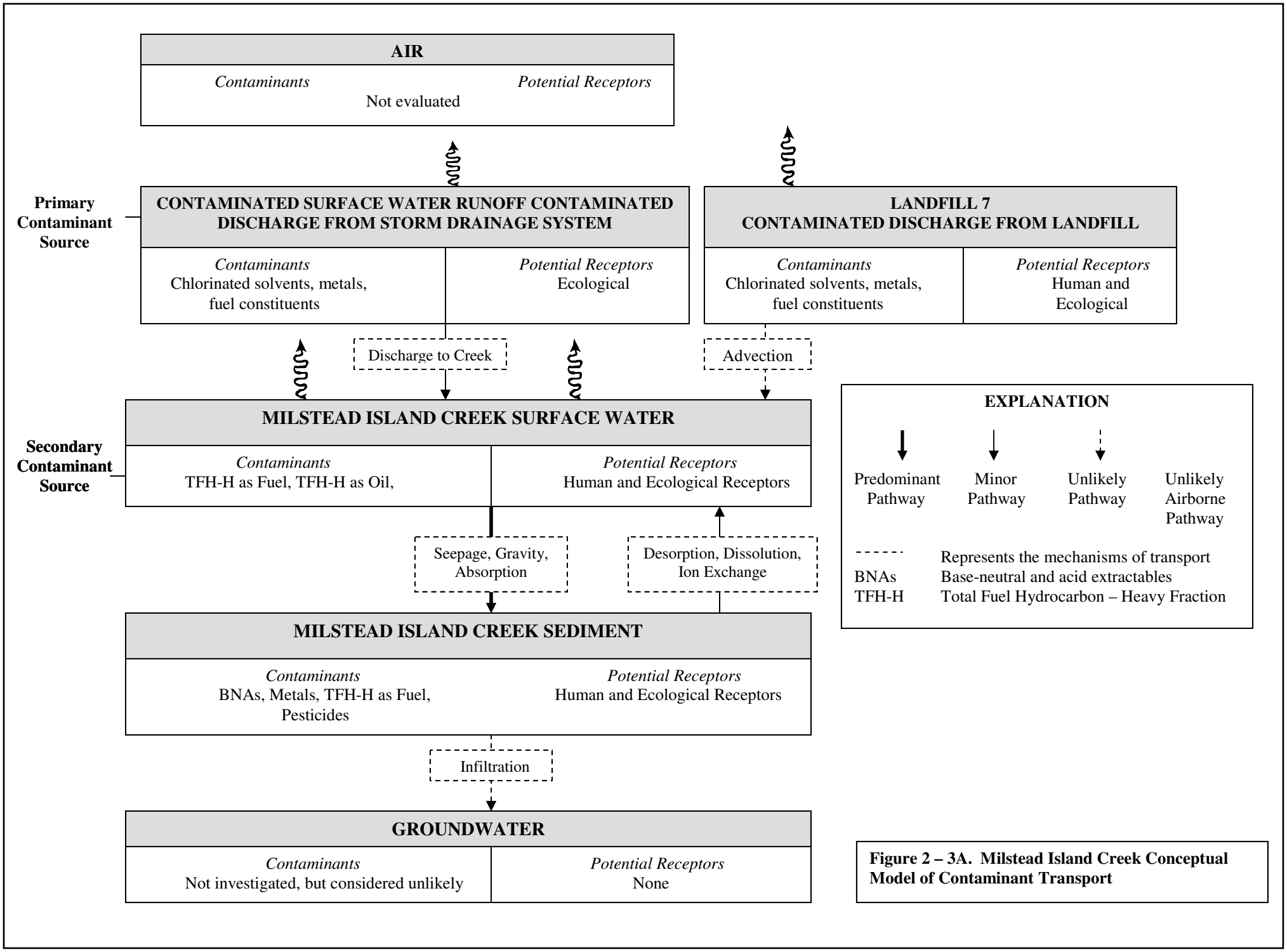

Figure 2 – 3A. Milstead Island Creek Conceptual Model of Contaminant Transport

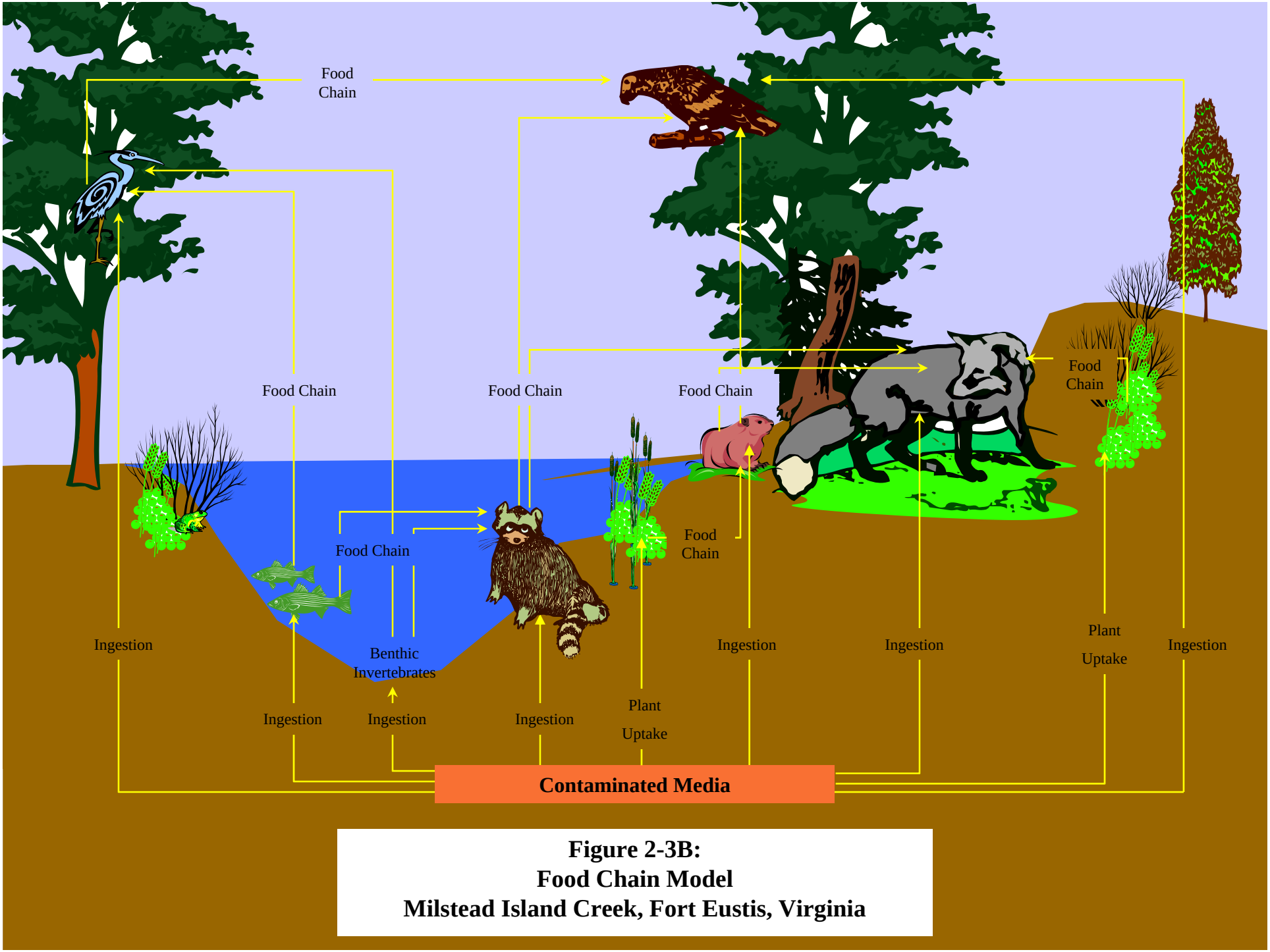

Figure 2-3B:
Food Chain Model
Milstead Island Creek, Fort Eustis, Virginia

Tables

Record of Decision
Milstead Island Creek
Fort Eustis, Virginia

TABLE 2-1
AREA NO. 1 SEDIMENT SAMPLES
MILSTEAD ISLAND CREEK

Parameters	Sample ID and Results					BTAG [1]	
	AREA 1						
	SD18-MC01-06-1	SD18-MC02-06-1	SD18-MC03-06-1	SD18-MC04-06-1	SD18-MC04-06-1D	Flora	Fauna
Pesticides (ug/kg)							
alpha-BHC	2.9UX	3.8UX	5.5UX	3.7UX	3.3UX	---	---
beta-BHC	2.9U	3.8U	5.5U	3.7U	3.3U	---	---
delta-BHC	2.9U	3.8U	5.5U	3.7U	3.3U	---	---
gamma-BHC	2.9U	3.8U	5.5U	3.7U	3.3U	---	---
Heptachlor	2.9U	3.8U	5.5U	3.7U	3.3U	---	---
Aldrin	2.9U	3.8U	5.5U	3.7U	3.3U	---	---
Heptachlor epoxide	**0.27JP**	**0.89J**	**0.50JP**	**0.41JP**	3.3U	---	---
Endosulfan I	2.9U	3.8U	5.5U	3.7U	3.3U	---	---
Dieldrin	5.7U	**1.2JP**	**1.4J**	**1.1JP**	**0.68J**	---	---
4,4-DDE	***2.5DJP*** [2]	***4.8DJP*** [2]	***20DJ*** [2]	***5.2DJ*** [2]	***3.6DJP*** [2]	2.2	2.2
Endrin	5.7U	7.3U	11U	7.2U	6.5U	---	---
Endrin aldehyde	5.7U	**2.7J**	11U	7.2U	6.5U	---	---
Endosulfan II	5.7U	7.3U	11U	7.2U	6.5U	---	---
4,4-DDD	5.7U	**1.4J**	**1.4JP**	**2.3J**	**1.4J**	16	16
Endosulfan sulfate	5.7U	7.3U	11U	**1.3J**	**1.1J**	---	---
4,4-DDT	**0.80JP**	***1.7JP***	11U	**1.2JP**	**1.0J**	1.58	1.58
Endrin ketone	5.7U	7.3U	11U	7.2U	6.5U	---	---
Methoxychlor	29U	**1.6JP**	55U	37U	**2.0J**	---	---
alpha-Chlordane	2.9U	3.8U	5.5U	3.7U	3.3U	---	---
gamma-Chlordane	**0.49J**	**0.47JP**	**0.83J**	**0.59JP**	**0.44JP**	---	---
Toxaphene	290U	380U	550U	370U	330U	---	---
Low Level PAHs (ug/kg)							
Naphthalene	12U	**2.8J**	22U	**2.7J**	13U	160	160
Acenaphthylene	12U	15U	22U	14U	13U	44	44
Acenaphthene	12U	**3.6J**	22U	14U	13U	16	16
Fluorene	**2.8J**	**6.6J**	**5.5J**	**3.9J**	**2.8J**	19	19
Phenanthrene	**20**	**63**	**15J**	**20**	**8.4J**	240	240
Anthracene	**6.4J**	**22**	**5.5J**	**6.8J**	**3.1J**	---	85.3
Fluoranthene	**79**	**240**	**80**	**120**	**60**	600	600
Pyrene	**97**	**320**	**94**	**130**	**64**	665	665
Chrysene	**44**	**170**	**45**	**42**	**20**	384	384
Benzo(a)anthracene	**35**	**110**	**28**	**41**	**18**	261	261
Benzo(b)fluoranthene	**54**	**110**	**54**	**48**	**24**	3200	3200
Benzo(k)fluoranthene	**39**	**120**	**36**	**53**	**22**		
Benzo(a)pyrene	**31**	**88**	22U	14U	13U	430	430
Indeno(1,2,3-cd)pyrene	**4.1J**	**18**	22U	14U	13U	600	600
Dibenzo(a,h)anthracene	12U	15U	22U	14U	13U	63.4	63.4
Benzo(g,h,I)perylene	**10J**	**32**	**12J**	**11J**	**4.5J**	670	670
2-Methylnaphthalene	**1.5J**	**3.7J**	**4.7J**	**6.6J**	**3.1J**	70	70
1-Methylnaphthalene	12U	**2.8J**	22U	**4.0J**	13U	---	---

TABLE 2-1
AREA NO. 1 SEDIMENT SAMPLES
MILSTEAD ISLAND CREEK

Parameters	Sample ID and Results					BTAG [1]	
	AREA 1						
	SD18-MC01-06-1	SD18-MC02-06-1	SD18-MC03-06-1	SD18-MC04-06-1	SD18-MC04-06-1D	Flora	Fauna
Total Metals (mg/kg)							
Aluminum	**4000**	**7400**	**19000**	**13000**	**10000**	---	---
Antimony	**3.1UN**	**4.0UN**	**6.5UN**	**4.3UN**	**3.6UN**	---	150
Arsenic	**1.3B**	**3.0**	**6.0**	**5.2**	**4.1**	8.2	8.2
Barium	**15**	**25**	**56**	**47**	**43**	---	---
Beryllium	**0.30B**	**0.53B**	**1.2B**	**0.86B**	**0.69B**	---	---
Cadmium	**0.088B**	**0.39B**	**0.47B**	**0.30B**	**0.20B**	5.1	1.2
Calcium	**1500**	**950**	**1700**	**1600**	**1200**	---	---
Chromium	***8.5***	***15***	***32***	***26***	***18***	0.005	260
Cobalt	**2.4**	**4.8**	**9.1**	**7.7**	**5.6**	---	---
Copper	**10**	**22**	***42***	**33**	**27**	---	34
Iron	**7500**	**14000**	**34000**	**25000**	**19000**	---	---
Lead	**10**	**21**	***47***	**33**	**25**	---	46.7
Magnesium	**1300N**	**2100N**	**4500N**	**3500N**	**2600N**	---	---
Manganese	**59**	**110**	**210**	**320**	**160**	---	---
Nickel	**4.0B**	**7.8B**	**16**	**13**	**9.6**	20.9	20.9
Potassium	**740N**	**1200N**	**2800N**	**1900N**	**1500N**	---	---
Selenium	1.6U	2.0U	3.2U	2.2U	1.8U	---	---
Silver	1.6U	**0.64B**	**2.1B**	**0.85B**	**1.7B**	---	1
Sodium	**3500.0**	**4900**	**9800**	**5400**	**5400**	---	---
Thallium	1.6U	2.0U	3.2U	2.2U	2.2U	---	---
Vanadium	**13**	**22**	**50**	**38**	**38**	---	---
Zinc	**46.0**	**100.0**	**150.0**	***160.0***	***160.0***	---	150
Mercury	**0.063N**	**0.14N**	***0.55N***	***0.22N***	***0.22N***	0.15	0.15
Other Parameters							
Total Organic Carbon (mg/kg)	**16000**	**27000**	**49000**	**37000**	**28000**	**---**	**---**
pH	---	---	---	---	---	**---**	**---**
Percent Solids	**58**	**45**	**31**	**46**	**51**	**---**	**---**
Acid Volatile Sulfide (mg/kg)	---	330	---	38	---	**---**	**---**
Extractable Metals (mg/kg)							
Cadmium	---	**0.24**	---	**0.11B**	---	**---**	**---**
Copper	---	**6.9N**	---	**4.1N**	---	**---**	**---**
Nickel	---	**0.99B**	---	**0.93B**	---	**---**	**---**
Zinc	---	54E	---	**33E**	---	**---**	**---**
Lead	---	**12**	---	**7.1**	---	**---**	**---**

Notes:
(1) BTAG - EPA Region III BTAG Screening Levels for Ecological Receptors (Aug 1995)
(2) Value represents diluted sample results

Bolded indicates detects above the Method Detection Limits (MDLs)
Bolded and italicized indicates detects above the BTAG limits

Data Validation Qualifiers:
J - Estimated concentration
B - Inorganic Value greater than MDL but less than PQL
U - Not detected
P - Result may be biased low.
X - Matrix interference encountered
N - Spiked sample recovery not within control limits.
E - Reported value is estimated because of the presence of interferences.

TABLE 2-2
AREA NO. 2 SEDIMENT SAMPLES
MILSTEAD ISLAND CREEK

Parameters	Sample ID and Results					BTAG [1]	
	AREA 2						
	SD18-MC01-06-2	SD18-MC02-06-2	SD18-MC02-06-2D	SD18-MC03-06-2	SD18-MC04-06-2	Flora	Fauna
Pesticides (ug/kg)							
alpha-BHC	3.6UX	4.4UX	3.6UX	5.0UX	4.4UX	---	---
beta-BHC	3.6U	4.4U	3.6U	5.0U	4.4U	---	---
delta-BHC	3.6U	4.4U	3.6U	5.0U	4.4U	---	---
gamma-BHC	3.6U	4.4U	3.6U	5.0U	4.4U	---	---
Heptachlor	3.6U	4.4U	**0.47JP**	5.0U	**0.66J**	---	---
Aldrin	3.6U	4.4U	3.6U	5.0U	4.4U	---	---
Heptachlor epoxide	**0.67J**	**0.62J**	3.6U	5.0U	**0.83J**	---	---
Endosulfan I	3.6U	4.4U	3.6U	5.0U	4.4U	---	---
Dieldrin	**1.1J**	8.5U	7.0U	9.7U	**1.0J**	---	---
4,4-DDE	***2.7J***	***4.2J***	***3.6J***	***4.7J***	***3.2JP***	2.2	2.2
Endrin	7.0U	8.5U	7.0U	9.7U	8.5U	---	---
Endrin aldehyde	7.0U	8.5U	7.0U	9.7U	8.5U	---	---
Endosulfan II	7.0U	8.5U	7.0U	9.7U	8.5U	---	---
4,4-DDD	**1.2JP**	**2.1J**	**1.6J**	**2.1J**	**3.3J**	16	16
Endosulfan sulfate	7.0U	**1.5J**	7.0U	9.7U	8.5U	---	---
4,4-DDT	7.0U	***2.4J***	7.0U	9.7U	**0.93JP**	1.58	1.58
Endrin ketone	7.0U	8.5U	7.0U	9.7U	8.5U	---	---
Methoxychlor	36U	44U	36U	50U	44U	---	---
alpha-Chlordane	3.6U	4.4U	3.6U	18U	4.4U	---	---
gamma-Chlordane	**0.69J**	4.4U	3.6U	18U	**0.76JP**	---	---
Toxaphene	360U	440U	360U	1800U	440U	---	---
Low Level PAHs (ug/kg)							
Naphthalene	**4.4J**	17U	14U	20U	**3.0J**	160	160
Acenaphthylene	14U	17U	14U	20U	**3.7J**	44	44
Acenaphthene	**4.5J**	17U	14U	20U	17U	16	16
Fluorene	**6.8J**	17U	14U	**5.3J**	**6.4J**	19	19
Phenanthrene	**27**	**6.4J**	**9.9J**	**20**	**20**	240	240
Anthracene	**16**	**4.8J**	**6.5J**	**9.1J**	**12J**	---	85.3
Fluoranthene	**300**	**42**	**62**	**140**	**210**	600	600
Pyrene	**340**	**44**	**76**	**160**	**220**	665	665
Chrysene	**130**	**22**	**41**	**63**	**77**	384	384
Benzo(a)anthracene	**110**	**14J**	**22**	**51**	**72**	261	261
Benzo(b)fluoranthene	**100**	**22**	**40**	**83**	**92**	3200	3200
Benzo(k)fluoranthene	**110**	**16J**	**30**	**59**	**70**		
Benzo(a)pyrene	**77**	17U	14U	**46**	**58**	430	430
Indeno(1,2,3-cd)pyrene	**17**	17U	14U	**9.4J**	**12J**	600	600
Dibenzo(a,h)anthracene	14U	17U	14U	20U	17U	63.4	63.4
Benzo(g,h,I)perylene	**21**	17U	14U	**15J**	**15J**	670	670
2-Methylnaphthalene	**4.8J**	17U	**2.0J**	**4.1J**	**3.5J**	70	70
1-Methylnaphthalene	14U	17U	14U	20U	17U	---	---

TABLE 2-2
AREA NO. 2 SEDIMENT SAMPLES
MILSTEAD ISLAND CREEK

Parameters	Sample ID and Results					BTAG [1]	
	AREA 2						
	SD18-MC01-06-2	SD18-MC02-06-2	SD18-MC02-06-2D	SD18-MC03-06-2	SD18-MC04-06-2	Flora	Fauna
Total Metals (mg/kg)							
Aluminum	**13000**	**13000**	**11000**	**17000**	**18000**	---	---
Antimony	**3.9UN**	**1.1BN**	**3.5UN**	**5.3UN**	**5.1UN**	---	150
Arsenic	**7.2**	**5.5**	**4.2**	**6.9**	**7.6**	8.2	8.2
Barium	**47**	**43**	**47**	**44**	**55**	---	---
Beryllium	**0.97**	**0.92B**	**0.76**	**1.10**	**1.20**	---	---
Cadmium	**0.30B**	**0.13B**	**0.12B**	**0.29B**	**0.28B**	5.1	1.2
Calcium	**1400**	**3400**	**3100**	**1800**	**1800**	---	---
Chromium	***26***	***21***	***18***	***29***	***32***	0.005	260
Cobalt	**8.9**	**7**	**6**	**9.7**	**10**	---	---
Copper	**31**	***40***	**31**	***54***	***47***	---	34
Iron	**28000**	**19000**	**16000**	**29000**	**32000**	---	---
Lead	**29**	**25**	**20**	**33**	**35**	---	46.7
Magnesium	**3500N**	**3400N**	**2800N**	**4500N**	**4500N**	---	---
Manganese	**340**	**180**	**160**	**260**	**320**	---	---
Nickel	**14**	**11**	**9.5**	**15**	**17**	20.9	20.9
Potassium	**2200N**	**2000N**	**1900N**	**2600N**	**2700N**	---	---
Selenium	1.9U	2.3U	1.8U	2.7U	2.6U	---	---
Silver	1.9U	**2.3U**	**1.8U**	2.7U	2.6U	---	1
Sodium	**5700.0**	**7500**	**5600**	**9500**	**7800**	---	---
Thallium	1.9U	1.5B	1.8U	2.7U	2.6U	---	---
Vanadium	**43**	**34**	**30**	**45**	**50**	---	---
Zinc	***170.0***	**97.0**	**78.0**	**150.0**	***200.0***	---	150
Mercury	**0.12N**	**0.091N**	**0.067N**	**0.14N**	**0.15N**	0.15	0.15
Other Parameters							
Total Organic Carbon (mg/kg)	**22000**	**36000**	**37000**	**34000**	**33000**	**---**	**---**
pH	---	---	---	---	---	**---**	**---**
Percent Solids	**47**	**39**	**47**	**34**	**39**	**---**	**---**
Acid Volatile Sulfide (mg/kg)	240	---	---	87	---	**---**	**---**
Extractable Metals (mg/kg)							
Cadmium	**0.071B**	---	---	**0.23**	---	**---**	**---**
Copper	**3.3N**	---	---	**12N**	---	**---**	**---**
Nickel	**0.99B**	---	---	**1.7B**	---	**---**	**---**
Zinc	**42E**	---	---	**66E**	---	**---**	**---**
Lead	**6**	---	---	**16**	---	**---**	**---**

Notes:
(1) BTAG - EPA Region III BTAG Screening Levels for Ecological Receptors (Aug 1995)
(2) Value represents diluted sample results

Bolded indicates detects above the Method Detection Limits (MDLs)
Bolded and italicized indicates detects above the BTAG limits

Data Validation Qualifiers:
J - Estimated concentration
B - Inorganic Value greater than MDL but less than PQL
U - Not detected
P - Result may be biased low.
X - Matrix interference encountered
N - Spiked sample recovery not within control limits.
E - Reported value is estimated because of the presence of interferences.

TABLE 2-3
AREA NO. 3 SEDIMENT SAMPLES
MILSTEAD ISLAND CREEK

Parameters	Sample ID and Results					BTAG [1]	
	AREA 3						
	SD18-MC01-06-3	SD18-DMC01-06-3	SD18-MC02-06-3	SD18-MC03-06-3	SD18-MC04-06-3	Flora	Fauna
Pesticides (ug/kg)							
alpha-BHC	61UX	59UX	47UX	59UX	59UX	---	---
beta-BHC	61U	59U	47U	59U	59U	---	---
delta-BHC	61U	59U	47U	59U	59U	---	---
gamma-BHC	61U	59U	47U	59U	59U	---	---
Heptachlor	61U	59U	47U	59U	59U	---	---
Aldrin	61U	59U	47U	59U	59U	---	---
Heptachlor epoxide	61U	59U	47U	59U	59U	---	---
Endosulfan I	61U	59U	47U	59U	59U	---	---
Dieldrin	120U	110U	92U	110U	110U	---	---
4,4-DDE	120U	110U	***19J***	110U	110U	2.2	2.2
Endrin	120U	110U	92U	110U	110U	---	---
Endrin aldehyde	120U	110U	92U	110U	110U	---	---
Endosulfan II	120U	110U	92U	110U	110U	---	---
4,4-DDD	120U	110U	92U	110U	110U	16	16
Endosulfan sulfate	120U	110U	92U	110U	110U	---	---
4,4-DDT	120U	110U	92U	***120***	110U	1.58	1.58
Endrin ketone	120U	110U	92U	110U	110U	---	---
Methoxychlor	610U	610U	470U	590U	590U	---	---
alpha-Chlordane	61U	59U	47U	59U	59U	---	---
gamma-Chlordane	61U	59U	47U	59U	59U	---	---
Toxaphene	6100U	5900U	4700U	5900U	5900U	---	---
Low Level PAHs (ug/kg)							
Naphthalene	**4.2J**	23U	19U	23U	23U	160	160
Acenaphthylene	24U	23U	19U	23U	23U	44	44
Acenaphthene	24U	23U	19U	23U	23U	16	16
Fluorene	24U	23U	19U	23U	23U	19	19
Phenanthrene	**15J**	**13J**	**5.6J**	**9.5J**	**12J**	240	240
Anthracene	**5.0J**	**4.8J**	19U	**4.5J**	**4.3J**	---	85.3
Fluoranthene	**65**	**58**	**20**	**37**	**47**	600	600
Pyrene	**72**	**70**	**24**	**54**	**59**	665	665
Chrysene	**52**	**71**	**14J**	**34**	**37**	384	384
Benzo(a)anthracene	**32**	**33**	**8.4J**	**18J**	**23J**	261	261
Benzo(b)fluoranthene	**76**	**52**	**18J**	**60**	**49**	3200	3200
Benzo(k)fluoranthene	24U	**59**	19U	23U	**34**	---	---
Benzo(a)pyrene	24U	23U	19U	23U	23U	430	430
Indeno(1,2,3-cd)pyrene	24U	23U	19U	23U	23U	600	600
Dibenzo(a,h)anthracene	24U	23U	19U	23U	23U	63.4	63.4
Benzo(g,h,I)perylene	**14J**	**13J**	19U	**14J**	23U	670	670
2-Methylnaphthalene	**4.4J**	**3.1J**	19U	**2.6J**	**2.8J**	70	70
1-Methylnaphthalene	24U	23U	19U	23U	23U	---	---

TABLE 2-3
AREA NO. 3 SEDIMENT SAMPLES
MILSTEAD ISLAND CREEK

Parameters	Sample ID and Results					BTAG (1)	
	AREA 3						
	SD18-MC01-06-3	SD18-DMC01-06-3	SD18-MC02-06-3	SD18-MC03-06-3	SD18-MC04-06-3	Flora	Fauna
Total Metals (mg/kg)							
Aluminum	**23000**	**25000**	**21000**	**24000**	**23000**	---	---
Antimony	6.5U	6.3U	4.6U	6.3U	6.9U	---	150
Arsenic	***8.7***	***9.5***	***9.4***	***8.9***	***8.6***	8.2	8.2
Barium	**47**	**51**	**49**	**52**	**52**	---	---
Beryllium	**1.3B**	**1.40**	**1.40**	**1.30**	**1.4B**	---	---
Cadmium	**0.25B**	**0.26B**	**0.20B**	**0.26B**	1.7U	5.1	1.2
Calcium	**2200**	**2200**	**1600**	**2200**	**2300**	---	---
Chromium	***35***	***38***	***31***	***35***	***36***	0.005	260
Cobalt	**9.8**	**11**	**10**	**10**	**11**	---	---
Copper	***100***	***110***	**32**	***96***	***98***	---	34
Iron	**31000**	**35000**	**30000**	**32000**	**33000**	---	---
Lead	**38**	**40**	**33**	**39**	**42**	---	46.7
Magnesium	**5600**	**5800**	**4800**	**5400**	**5900**	---	---
Manganese	**360**	**390**	**210**	**290**	**300**	---	---
Nickel	**17**	**19**	**17**	**18**	**19**	20.9	20.9
Potassium	**3100**	**3300**	**3100**	**3100**	**3300**	---	---
Selenium	3.2U	3.1U	2.3U	3.1U	3.4U	---	---
Silver	3.2U	3.1U	2.3U	3.1U	3.4U	---	1
Sodium	**13000.0**	**12000**	**8700**	**9800**	**12000**	---	---
Thallium	3.2U	3.1U	2.3U	3.1U	3.4U	---	---
Vanadium	**50**	**54**	**52**	**51**	**53**	---	---
Zinc	**140.0**	**150.0**	**94.0**	**140.0**	**150.0**	---	150
Mercury	**0.13**	**0.15**	**0.13**	**0.14**	**0.13**	0.15	0.15
Other Parameters							
(mg/kg)	**56000**	**56000**	**52000**	**54000**	**51000**	**---**	**---**
pH	---	---	---	---	---	**---**	**---**
Percent Solids	**28**	**29**	**36**	**29**	**29**	**---**	**---**
Acid Volatile Sulfide (mg/kg)	320	---	---	---	880	**---**	**---**
(mg/kg)							
Cadmium	**0.15B**	---	---	---	**0.12B**	**---**	**---**
Copper	**10N**	---	---	---	**6.6N**	**---**	**---**
Nickel	**1.2B**	---	---	---	**1.0B**	**---**	**---**
Zinc	**43E**	---	---	---	**32E**	**---**	**---**
Lead	**14**	---	---	---	**8.7**	**---**	**---**

Notes:

(1) BTAG - EPA Region III BTAG Screening Levels for Ecological Receptors (Aug 1995)

(2) Value represents diluted sample results

Bolded indicates detects above the Method Detection Limits (MDLs)

Bolded and italicized indicates detects above the BTAG limits

Data Validation Qualifiers:

J - Estimated concentration

B - Inorganic Value greater than MDL but less than PQL

U - Not detected

P - Result may be biased low.

X - Matrix interference encountered

N - Spiked sample recovery not within control limits.

E - Reported value is estimated because of the presence of interferences.

TABLE 2-4
REFERENCE AREA SEDIMENT SAMPLES
MILSTEAD ISLAND CREEK

Parameters	Sample ID and Results				BTAG [1]	
	SD18-RM01-06	SD18-RM02-06	SD18-RM03-06	SD18-RM04-06	Flora	Fauna
VOCs (ug/kg)						
Chloromethane	80U	80U	90U	87U	---	---
Bromomethane	80U	80U	90U	87U	---	---
Vinyl chloride	80U	80U	90U	87U	---	---
Chloroethane	80U	80U	90U	87U	---	---
Methylene chloride	40U	40U	45U	43U	---	---
Acetone	**85J**	**200J**	**220J**	**180J**	---	---
Carbon Disulfide	40U	40U	**37J**	43U	---	---
1,1-Dichloroethene	40U	40U	45U	43U	---	---
1,1-Dichloroethane	40U	40U	45U	43U	---	---
Cis/Trans-1,2-Dichloroethene	40U	40U	45U	43U	---	---
Chloroform	40U	40U	45U	43U	---	---
1,2-Dichloroethane	40U	40U	45U	43U	---	---
2-Butanone (MEK)	**32J**	**41J**	**46J**	**42J**	---	---
1,1,1-Trichloroethane	40U	40U	45U	43U	---	---
Carbon tetrachloride	40U	40U	45U	43U	---	---
Bromochloromethane	40U	40U	45U	43U	---	---
1,1,2,2-Tetrachloroethane	40U	40U	45U	43U	---	---
1,2-Dichloropropane	40U	40U	45U	43U	---	---
trans-1,3-Dichloropropene	40U	40U	45U	43U	---	---
Trichloroethene	40U	40U	45U	43U	---	---
Dibromomethane	40U	40U	45U	43U	---	---
1,1,2-Trichloroethane	40U	40U	45U	43U	---	---
Benzene	40U	40U	45U	43U	---	---
cis-1,3-Dichloropropene	40U	40U	45U	43U	---	---
Bromoform	40U	40U	45U	43U	---	---
2-Hexanone	200U	200U	230U	220U	---	---
4-Methyl-2-pentanone (MIBK)	200U	200U	230U	220U	---	---
Tetrachloroethene	40U	40U	45U	18U	---	57
Toluene	40U	40U	45U	18U	---	---
Chlorobenzene	40U	40U	45U	18U	---	---
Ethylbenzene	40U	40U	45U	18U	---	10
Styrene	40U	40U	45U	18U	---	---
Xylenes	80U	80U	90U	87U	---	40
SVOCs (ug/kg)						
Phenol	1400U	1400U	1400U	1400U	---	420
bis(2-Chloroethyl)ether	1400U	1400U	1400U	1400U	---	---
2-Chlorophenol	1400U	1400U	1400U	1400U	---	---
1,3-Dichlorobenzene	1400U	1400U	1400U	1400U	---	---
1,4-Dichlorobenzene	1400U	1400U	1400U	1400U	---	---
1,2-Dichlorobenzene	1400U	1400U	1400U	1400U	---	---
2-Methylphenol (o-Cresol)	1400U	1400U	1400U	1400U	---	---
2,2'-Oxybis(1-Chloropropane) (bis-2-chloroisopropyl ether)	1400U	1400U	1400U	1400U	---	---

TABLE 2-4
REFERENCE AREA SEDIMENT SAMPLES
MILSTEAD ISLAND CREEK

Parameters	Sample ID and Results				BTAG [1]	
	SD18-RM01-06	SD18-RM02-06	SD18-RM03-06	SD18-RM04-06	Flora	Fauna
SVOCs (ug/kg) (Cont'd)						
3-Methylphenol/4-Methylphenol (m&p-Cresol)	1400U	1400U	1400U	1400U	---	---
N-Nitroso-di-n-propylamine	1400U	1400U	1400U	1400U	---	28
Hexachloroethane	1400U	1400U	1400U	1400U	---	---
Nitrobenzene	1400U	1400U	1400U	1400U	---	---
Isophorone	1400U	1400U	1400U	1400U	---	---
2-Nitrophenol	1400U	1400U	1400U	1400U	---	---
2,4-Dimethylphenol	1400U	1400U	1400U	1400U	---	---
bis(2-Chloroethoxy)methane	1400U	1400U	1400U	1400U	---	---
2,4-Dichlorophenol	1400U	1400U	1400U	1400U	29	29
1,2,4-Trichlorobenzene	1400U	1400U	1400U	1400U	---	---
Naphthalene	1400U	1400U	1400U	1400U	160	160
4-Chloroaniline	2700U	2900U	2700U	2700U	---	---
Hexachlorobutadiene	1400U	1400U	1400U	1400U	11	11
4-Chloro-3-methylphenol	1400U	1400U	1400U	1400U	---	---
2-Methylnaphthalene	1400U	1400U	1400U	1400U	70	70
Hexachlorocyclopentadiene	1400U	1400U	1400U	1400U	---	---
2,4,6-Trichlorophenol	1400U	1400U	1400U	1400U	---	---
2,4,5-Trichlorophenol	1400U	1400U	1400U	1400U	---	---
2-Chloronaphthalene	1400U	1400U	1400U	1400U	---	---
2-Nitroaniline	7100U	7400U	7100U	7100U	---	---
Dimethylphthalate	1400U	1400U	1400U	1400U	---	71
Acenaphthylene	1400U	1400U	1400U	1400U	44	44
3-Nitroaniline	7100U	7400U	7100U	7100U	---	---
Acenaphthene	1400U	1400U	1400U	1400U	16	16
2,4-Dinitrophenol	7100U	7400U	7100U	7100U	---	---
4-Nitrophenol	7100U	7400U	7100U	7100U	---	---
Dibenzofuran	1400U	1400U	1400U	1400U	540	540
2,4-Dinitrotoluene	1400U	1400U	1400U	1400U	---	---
2,6-Dinitrotoluene	1400U	1400U	1400U	1400U	---	---
Diethylphthalate	1400U	1400U	1400U	1400U	---	200
4-Chlorophenylphenyl ether	1400U	1400U	1400U	1400U	---	---
Fluorene	1400U	1400U	1400U	1400U	19	19
4-Nitroaniline	7100U	7400U	7100U	7100U	---	---
4,6-Dinitro-2-methylphenol	7100U	7400U	7100U	7100U	---	---
N-Nitrosodiphenylamine	1400U	1400U	1400U	1400U	---	---
4-Bromophenylphenyl ether	1400U	1400U	1400U	1400U	---	---
Hexachlorobenzene	1400U	1400U	1400U	1400U	22	22
Pentachlorophenol	7100U	7400U	7100U	7100U	360	360
Phenanthrene	1400U	1400U	1400U	1400U	240	240
Anthracene	1400U	1400U	1400U	1400U	---	85
Di-n-butylphthalate	1400U	1400U	1400U	140J	---	1,300
Fluoranthene	1400U	1400U	1400U	1400U	600	600
Pyrene	1400U	1400U	1400U	**1400U**	665	665

TABLE 2-4
REFERENCE AREA SEDIMENT SAMPLES
MILSTEAD ISLAND CREEK

Parameters	Sample ID and Results				BTAG [1]	
	SD18-RM01-06	SD18-RM02-06	SD18-RM03-06	SD18-RM04-06	Flora	Fauna
SVOCs (ug/kg) (Cont'd)						
Butylbenzylphthalate	1400U	1400U	1400U	1400U	---	63
3,3'-Dichlorobenzidine	2700U	2900U	2700U	2700U	---	---
Benzo(a)anthracene	1400U	1400U	1400U	1400U	261	261
bis(2-Ethylhexyl)phthalate	1400U	1400U	1400U	1400U	---	1,300
Chrysene	1400U	1400U	1400U	1400U	384	384
Di-n-octylphthalate	1400U	1400U	1400U	1400U	---	6,200
Benzo(b)fluoranthene	1400U	1400U	1400U	1400U	3,200	3,200
Benzo(k)fluoranthene	1400U	1400U	1400U	1400U	---	---
Benzo(a)pyrene	1400U	1400U	1400U	1400U	430	430
Indeno(1,2,3-cd)pyrene	1400U	1400U	1400U	1400U	600	600
Dibenzo(a,h)anthracene	1400U	1400U	1400U	1400U	63.4	63.4
Benzo(g,h,i)perylene	1400U	1400U	1400U	1400U	670	670
Carbazole	1400U	1400U	1400U	1400U	---	---
Pesticides (ug/kg)						
alpha-BHC	71UX	74UX	71UX	71UX	---	---
beta-BHC	71U	74U	71U	71U	---	---
delta-BHC	71U	74U	71U	71U	---	---
gamma-BHC	71U	74U	71U	71U	---	---
Heptachlor	71U	74U	71U	71U	---	---
Aldrin	71U	74U	71U	71U	---	---
Heptachlor epoxide	71U	74U	71U	71U	---	---
Endosulfan I	71U	74U	71U	71U	---	---
Dieldrin	140U	140U	140U	140U	---	---
4,4-DDE	140U	140U	140U	***21J***	2.2	2.2
Endrin	140U	140U	140U	140U	---	---
Endrin aldehyde	140U	140U	140U	140U	---	---
Endosulfan II	140U	140U	140U	140U	---	---
4,4-DDD	140U	140U	140U	140U	16	16
Endosulfan sulfate	140U	140U	140U	140U	---	---
4,4-DDT	140U	140U	140U	140U	1.58	1.58
Endrin ketone	140U	140U	140U	140U	---	---
Methoxychlor	710U	740U	710U	710U	---	---
alpha-Chlordane	71U	74U	71U	71U	---	---
gamma-Chlordane	71U	74U	71U	71U	---	---
Toxaphene	7100U	7400U	7100U	7100U	---	---
PCBs (ug/kg)	1400U	1400U	1400U	1400U	22.7	22.7
Aroclor-1016	1400U	1400U	1400U	1400U	22.7	22.7
Aroclor-1221	2800U	2800U	2900U	2800U	22.7	22.7
Aroclor-1232	1400U	1400U	1400U	1400U	22.7	22.7
Aroclor-1242	1400U	1400U	1400U	1400U	22.7	22.7
Aroclor-1248	1400U	1400U	1400U	1400U	22.7	22.7
Aroclor-1254	1400U	1400U	1400U	1400U	22.7	22.7
Aroclor-1260	1400U	1400U	1400U	1400U	22.7	22.7

TABLE 2-4
REFERENCE AREA SEDIMENT SAMPLES
MILSTEAD ISLAND CREEK

Parameters	Sample ID and Results				BTAG (1)	
	SD18-RM01-06	SD18-RM02-06	SD18-RM03-06	SD18-RM04-06	Flora	Fauna
Total Metals (mg/kg)						
Aluminum	**47000**	**48000**	**19000**	**48000**	---	---
Antimony	7.6U	**1.5B**	7.6U	7.6U	---	150
Arsenic	***11.0***	***11.0***	**7.3**	***12.0***	8.2	8.2
Barium	**53**	**53**	**57**	**55**	---	---
Beryllium	**1.70**	**1.5B**	**1.5B**	**1.70**	---	---
Cadmium	**0.48B**	**0.30B**	1.9U	**0.36B**	5.1	1.2
Calcium	**2700**	**2400**	**3100**	**2500**	---	---
Chromium	***53***	***59***	***28***	***53***	0.005	260
Cobalt	**12**	**11**	**12**	**11**	---	---
Copper	***420***	***360***	**21**	***490***	---	34
Iron	**33000**	**30000**	**26000**	**31000**	---	---
Lead	***72***	**45**	**27**	***76***	---	46.7
Magnesium	**6600**	**5700**	**5900**	**5900**	---	---
Manganese	**370**	**390**	**300**	**370**	---	---
Nickel	**20**	**18**	**16**	**19**	20.9	20.9
Potassium	**2800**	**2400**	**3000**	**2500**	---	---
Selenium	**1.6B**	**1.8B**	3.8U	3.8U	---	---
Silver	3.8U	4.0U	3.8U	3.8U	---	1
Sodium	**15000**	**10000**	**15000**	**13000**	---	---
Thallium	3.8U	4.0U	3.8U	3.8U	---	---
Vanadium	**63**	**56**	**50**	**61**	---	---
Zinc	***160***	**150**	**60**	**150**	---	150
Mercury	***0.18***	**0.15**	**0.050B**	***0.18***	0.15	0.15
Other Parameters						
Total Organic Carbon (mg/kg)	**61000**	**57000**	**90000**	**60000**	**---**	**---**
pH	---	---	---	---	**---**	**---**
Percent Solids	**24**	**23**	**24**	**24**	**---**	**---**
Acid Volatile Sulfide (mg/kg)	---	150	---	43U	**---**	**---**
AVS Extractable Metals (mg/kg)						
Cadmium	---	**0.13B**	---	**0.062B**	**---**	**---**
Copper	---	**24N**	---	**6.3N**	**---**	**---**
Nickel	---	**1.0B**	---	**2.0B**	**---**	**---**
Zinc	---	**24E**	---	**14E**	**---**	**---**
Lead	---	**25**	---	**11**	**---**	**---**

Notes:
(1) BTAG - EPA Region III BTAG Screening Levels for Ecological Receptors (Aug 1995)
(2) Value represents diluted sample results

Bolded indicates detects above the Method Detection Limits (MDLs)
Bolded and italicized indicates detects above the BTAG limits

Data Validation Qualifiers:
J - Estimated concentration
B - Inorganic Value greater than MDL but less than PQL
U - Not detected
P - Result may be biased low.
X - Matrix interference encountered
N - Spiked sample recovery not within control limits.
E - Reported value is estimated because of the presence of interferences.

TABLE 2-5
CHEMICALS DETECTED IN SEDIMENTS
MILSTEAD ISLAND CREEK
FORT EUSTIS, VIRGINIA

Chemical	Number of Detects	Number of Samples Analyzed	Frequency Detected	Detection Limits		Detected Concentrations		NOAA Status & Trends Regional Background		Virginia Sediment Regional Background	
				Min	Max	Min	Max	Min	Max	Min	Max
TFH (µg/kg)	1	28	4%	13,800	36,000	69,000	69,000	NAP	NAP	NAP	NAP
Total Metals (mg/kg)											
Aluminum	13	13	100%	-	-	5,660	18,500	1,900	88,000	-	-
Arsenic	24	28	86%	1.5	4.4	2.3	13	1.8	26	0.9	25.2
Barium	28	28	100%	-	-	21	210	-	-	-	-
Beryllium	14	28	50%	0.7	1.78	0.35	2.9	-	-	0.65	5
Cadmium	0	28	0%	0.7	1.78	-	-	0.02	0.07	0.1	8.4
Chromium	28	28	100%	-	-	10	46	18	150	0.67	73.08
Copper	26	28	93%	20	20	6.5	170	2.4	63	0.6	44
Lead	28	28	100%	-	-	10	75	3.5	76	1.2	110
Mercury	15	28	54%	-	-	0.04	0.2	-	0.32	0.02	0.5
Nickel	14	28	50%	6.8	6.8	6.6	22	4.4	68	1.2	54
Selenium	3	28	11%	1.3	9	0.45	2.9	0.17	1.6	1	19.2
Silver	0	28	0%	1.38	3.6	-	-	0.01	1.2	-	-
Thallium	0	28	0%	4.6	17.8	-	-	0.16	0.55	1.4	10
Zinc	28	28	100%	-	-	38	1,300	5	390	3.5	560
Cyanide (mg/kg)	0	15	0%	0.2	0.72	-	-	-	-	-	-
Other (mg/kg)											
Solids, Percent	15	15	100%	-	-	28	72	-	-	-	-

References:

Final Remedial Investigation Report for Five Sites, Montgomery Watson, 1997.

NAP=Not Applicable

TABLE 2-6
SUMMARY OF COMPOUNDS OF POTENTIAL CONCERN
SURFACE WATER
MILSTEAD ISLAND CREEK
FORT EUSTIS, VIRGINIA

Chemical	Frequency Detected	Detection Limits		Detected Concentrations	
		Min	Max	Min	Max
TFH (µg/L)					
TFH-H as fuel	50%	12,000	12,000	330,000	910,000
TFH-H as oil	50%	24,000	24,000	420,000	740,000
VOCs (µg/L)					
Acetone	75%	50	50	17	120
Methylene Chloride	59%	5	10	1	3
BNAs (µg/L)					
bis (2-Ethhexyl) phthalate	6%	10	10	1	1
Di-n-butyl phthalate	12%	10	10	1	1
Di-n-octyl phthalate	6%	10	10	2	2
Total Metals (mg/L)					
Aluminum	95%	0.2	0.2	0.265	2.97
Arsenic	6%	0.0015	0.01	0.0016	0
Barium	10%	-	-	0.012	0
Beryllium	24%	0.001	0.005	0.0014	0.0017
Calcium	10%	-	-	16	18
Copper	65%	0.2	0.025	0.022	0.054
Iron	10%	-	-	0.11	1.9
Lead	59%	0.0025	0.005	0.0026	0.0066
Magnesium	10%	-	-	11	25
Manganese	10%			0.021	0.092
Potassium	10%			3.9	8.5
Selenium	12%	0.0013	0.01	0.007	0.0081
Sodium	10%	-	-	88	230
Thallium	24%	0.0022	0.01	0.0024	0.0039
Zinc	83%	0.02	0.02	0.0063	0.083
Dissolved Metals (mg/L)					
Aluminum	20%	0.1	0.1	0.94	0.94
Barium	10%	-	-	0.011	0.037
Calcium	10%	-	-	16	18
Iron	10%	-	-	0.068	1
Magnesium	10%	-	-	11	24
Manganese	10%	-	-	0.02	0.0075
Potassium	10%	-	-	3.7	8.5
Silicon (as SiO)	10%	-	-	4.6	6
Sodium	10%	-	-	89	220

References:

Final Remedial Investigation Report for Five Sites, Montgomery Watson, 1997.

- = Value Not Available

TABLE 2-7
MAMMALIAN HAZARD QUOTIENT SUMMARY
MILSTEAD ISLAND CREEK
FORT EUSTIS, VIRGINIA

Chemical	Raccoon	Gray Fox	Muskrat
4,4-DDE	**2.61E+00**	5.38E-03	3.24E-01
4,4-DDT	**2.18E+01**	3.31E-02	**2.71E+00**
Aluminum	8.90E-01	**2.36E+04**	**8.69E+00**
Arsenic	4.91E-01	**2.32E+01**	1.86E-01
Chromium	1.39E-01	9.74E-04	2.58E-02
Copper	3.71E-02	2.23E-02	3.94E-02
Silver	NA	NA	NA
Zinc	2.12E-03	7.36E-04	4.30E-03

TABLE 2-8
AVIAN HAZARD QUOTIENT SUMMARY
MILSTEAD ISLAND CREEK
FORT EUSTIS, VIRGINIA

Chemical	Great Blue Heron	Red-tailed Hawk
4,4-DDE	**5.25E+02**	**4.98E+02**
4,4-DDT	**4.35E+03**	**4.16E+03**
Aluminum	**8.52E+00**	**8.15E+00**
Arsenic	5.34E-02	5.11E-02
Chromium	**1.68E+03**	**1.61E+03**
Copper	1.26E-02	1.21E-02
Silver	NA	NA
Zinc	1.68E-02	1.61E-02